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(54) **An aqueous hair conditioning composition containing a silicone polymer and a cationic polymer and method for conditioning hair**

(57) A hair conditioning composition comprises a silicone polymer (e.g. a polydimethylsiloxane containing aminoethylaminopropyl groups) and a cationic polymer (e.g. cyclized dimethyldiallyl ammonium chloride polymers and copolymers thereof with acrylamide, poly(dimethyl butenyl ammonium) chloride compounds and quaternized polyvinyl pyridine) in an aqueous medium and a method of conditioning hair involving the application of said composition to the hair.

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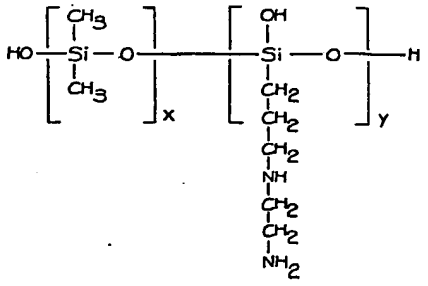
SPECIFICATION

An aqueous hair conditioning composition containing a silicone polymer and a cationic polymer and method for conditioning hair

This invention relates to compositions that are useful in conditioning hair and to processes for conditioning hair that employ such compositions.

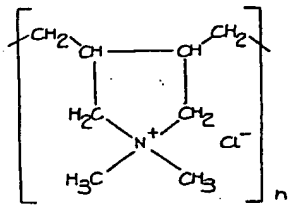
It is known in the prior art to treat hair with certain quaternary amine compounds for the purpose of conditioning hair, i.e. to improve its combability, manageability, to impart soft feel, lustrous appearance, etc. Although such prior art compositions have proven effective in varying degrees, one of the chief drawbacks has been the transiency of the effect, i.e. it does not survive repeated shampooing. Some improvement in conditioning stability to shampooing can be attained with certain classes of silicone polymers. Examples of such polymers is amodimethicone, the structural formula of which is:

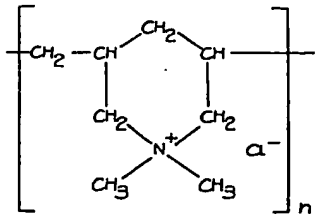


where x and y are cardinal numbers depending on molecular weight and the weight average molecular weight is approximately between 5,000 and 100,000. However, even the use of such silicone polymers leaves something to be desired.

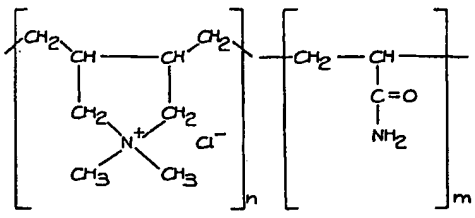
It has been now found that both the conditioning efficacy and the durability of the conditioning effect of such silicone polymers can be greatly enhanced by incorporating into the conditioning formulation one or more cationic polymers. The polymers that are useful for the purposes of the pesent invention can vary over a wide range. Cationic polymers that have been found to be particularly useful herein are those sold under the trade name MERQUAT (e.g. MERQUAT 100 and MERQUAT 550), ONAMER (e.g. ONAMER M) and quaternized polyvinyl pyridines.

MERQUAT 100 is a polymer of dimethyldiallyl amonium chloride and are probably mixtures of compounds having the following formulas:



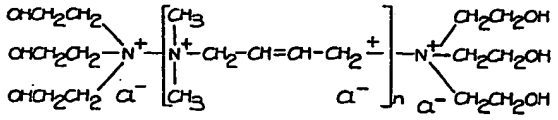


These vary in molecular weight and n is a cardinal number which depends on molecular weight. Ordinarily, however, the polymers of this class that will be employed have a molecular weight in the range of from about 4,000 to about 550,000 and preferably in the range of from about 20,000 to about 100,000. MERQUAT 550 is a copolymers of dimethyldiallyl ammonium chloride and acrylamide. This is believed to have the formula:



and a molecular weight in the range of from about 5,000 to about 550,000, and n and m are cardinal numbers which depend on molecular weight.

The ONAMER type polymers that are useful for the present purposes are poly(dimethylbutenyl ammonium chloride)-α,ϖ - bis(triethanol ammonium chloride) compounds that may be described by the general formula:

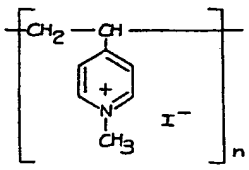


wherein n is a cardinal number which is molecular weight dependent. The molecular weights of these polymers that may be employed will be in the range from about 800 to about 5000 and preferably in the range of from about 1000 to about 3000.

A third variety of cationic materials that have been found particularly useful are polymers and copolymers of quaternized polyvinylpyridine. These are described by the general formula:

Wherein R is an alkyl radical of C_1-C_{20} and the and the X^- is an anion such as a halide, sulfate or carboxylate, and n is a cardinal number which depends on molecular weight. These also will have a molecular weight in the range of from about 5000 to about 100,000.

As an example of the cationic polymer of this group, the following may be mentioned:



polyvinyl methyl pyridinium iodide having an average M.W. of 50,000.

The quantity of cationic polymer contained in the formulation will depend on the particular results that are desired. Ordinarily, this will constitute between about .01% to about 10% by weight based on the total weight of the aqueous compositions with the optimal range being between about .05% to about 3% on the same weight basis.

The amount of silicone polymer that will be incorporated in the present hair conditioning composition may also vary somewhat. Usually, however, this will comprise from about 0.2% to about 10% by weight based on the total weight of the composition and preferably from about 1% to about 4%.

Although the cationic polymers mentioned above and the silicone polymers are the essential active ingredients in the present compositions, the compositions contemplated by the present invention may also contain other ingredients which may serve to improve the organoleptic character of the product or its ease of application. Thus, it is within the purview of this invention to incorporate such materials as fragrance, thickening agents, opacifiers, etc. in the compositions of this invention.

The carrier for delivering the compositions of the present invention will generally be an aqueous vehicle. This may take any of a variety of forms e.g. solutions, aqueous emulsions, aqueous gels, etc. As used herein, the term aqueous carrier is intended to include the cases wherein water is essentially the only material that constitutes the vehicle as well as those cases wherein the water is mixed with subtantial quantities of other ingredients e.g. solvents, thickening agents, emulsifying agents, gelling agents, etc.

The compositions of the present invention may be applied to hair in any suitable manner. One typical procedure involves applying the conditioning composition, such as described in Example I below to freshly shampooed hair, working it gently into the hair mass, leaving the said composition on hair for one to five minutes and rinsing the hair thoroughly with water prior to combing. The amount of the conditioning composition applied to hair may vary but, in general, should not be less than 1% of the hair weight and does not exceed 20% of the hair weight.

The following Examples are given to further illustrate the present invention. It is to be understood, however, that the invention is not limited thereto.

Example I

Ingredient	% by weight
Silicone Polymer (Amodimethicone)* in form of emulsion	1.6
Merquat 100**	1.6
Hydroxyethyl cellulose	1.5
Citric acid	0.5
Water QS to	100.0

*CTFA name (RD Number 977069–10–5). The commercial product is Dow-Corning Cationic Emulsion 929 which is a mixture of the emulsified polymer and 1.9% tallow trimethyl ammonium dichloride, and 1.7% Nonoxynol-10, an alkyl phenoxy polyoxy ethylene ethanol with 10 mols ethylene oxide.
**CTFA name Quaternium M-40 (RD Number 977066–02–6)

Example II

Ingredient	% by weight
Amodmethicone	1.6
Polyvinyl allyl pyridinium sulfate	1.6
Hydroxyethyl cellulose	1.5
Citric acid	0.5
Water QS to	100.0

Example III

Ingredient	% by weight
Amodimethicone	1.6
Merquat 550	0.8
Polyvinyl methyl pyridinium iodide	0.8
Hydroxyethyl cellulose	1.5
Citric acid	0.5
Water QS to	100.0

Example IV

Ingredient	% by weight
Silicone Polymer (Amodimethicone) in form of emulsion (Dow Corning Cationic Emulsion 929)	2.0
Onamer M***	1.5
Hydroxyethyl cellulose	1.2
Water QS to	100.0

***poly(dimethyl butenyl ammonium chloride)-α,ϖ-bis(tri-ethanol ammonium chloride) Av. M.W. about 1000–2000.

Example V

Ingredient	% by weight
Silicone Polymer (Amodimethicone) in form of emulsion (Dow Corning Cationic Emulsion 929)	1.75
Stearyl alcohol	1.6
Glyceryl monostearate	1.5
Mineral oil	0.8
Merquat 550****	0.4
Propyl paraben	0.5
Water QS to	100.0

****CTFA name Quaternium M-41 (RD Number 977066-03-7)

The conditioning efficacy and durability is illustrated in the following experiment, the normal, Caucasian hair being used as the test substrate.

Swatches of intact Caucasian hair were shampooed with Herbal Essence Shampoo in accordance with the instructions present on the label. The ratio of the amount of shampoo to weight of hair and quantity of water used for rinsing after shampooing were all maintained so as to simulate conditions on the head. After rinsing, the conditioning material of Example I above was applied to hair (0.1 g of each product per 1 g of hair). It was worked in for 30 seconds and left on the hair for an additional minute after which time the hair was rinsed and combed. The combing measurements were performed by the procedure described in the paper by Garcia and Diaz (J. Soc. Cosmetic Cheem, *27*, 379, 1976). The test essentially involves passing of a hair tress through a comb attached to a strain gauge which in turn is connected to a recording device. Force is expended to accomplish the passage of the tress through the comb, and the maximum force read off the recorded in the objective measure of combing ease.

Having determined the combing properties of hair after shampooing and conditioning treatments, the swatches were shampooed five times and again tested for combing. The results of combability tests are summarized in Table I below. In the Table, the "Maximum Combing Force" is expressed in units of Gram Force (G). The higher the values, the harder it was to comb the hair.

TABLE I

Effect of Conditioning on Combing Ease

Procedure #	Treatment	Maximum Combing Force(G)
1	Shampooing	80
2	Proc. (1) followed by treatment with conventional conditioner	42
3	Proc. (2) followed by 5 shampoos	97
4	Proc. (1) followed by treatment with composition for Example I without the Merquat	29
5	Proc. (4) followed by 5 shampoos	60
6	Proc. (1) followed by treatment with composition from Example I	12
7	Proc. (6) followed by 5 shampoos	18

Even better durability of conditioning properties was obtained with compositions of Example IV. Again, freshly shampooed, brown Caucasian hair tresses were used in the experiment. The results are given in Table II below.

TABLE II

Effect of Conditioning on Combing Ease

Procedure #	Treatment	Maximum Combing Force (G)
1	Shampooing	92
2	Proc. (1) followed by treatment with composition of Example II without the Onamer	19
3	Proc. (2) followed by 10 consecutive shampooings	79
4	Proc. (1) followed by treatment with composition Example II	11
5	Proc. (4) followed by 10 consecutive shampooings	16

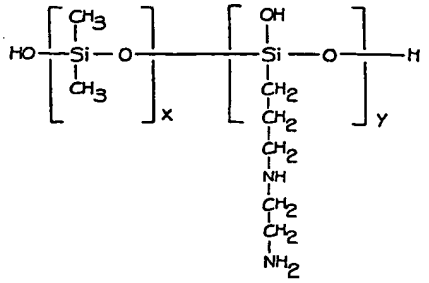
Although the invention has been described with reference to specific forms thereof, it will be understood that many changes and modifications may be made without departing from the scope of this invention.

CLAIMS

1. An aqueous composition useful in conditioning hair comprising, on a weight basis and based on the total weight of the composition:
(a) from about 0.2% to about 10% of a silicone polymer;
(b) from about .01 to about 10% of at least one cationic polymer; and
(c) an aqueous carrier.

2. A composition according to claim 1 in which said silicone polymer comprises from about 1% to about 4% by weight of said composition and said cationic polymer comprises from about .05% to about 3% by weight.

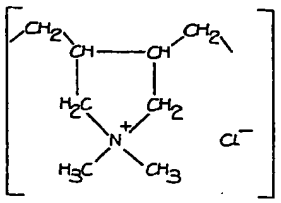
3. A composition according to claim 1 or 2 in which said silicone polymer is in the form of an aqueous emulsion of a polymer constituted of the following structural units:

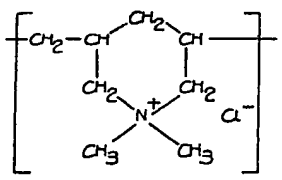


wherein x and y are cardinal numbers depending on molecular weight and the weight average molecular weight of the polymer is approximately between 5,000 and 100,000.

4. A composition according to any of claims 1 – 3 in which said cationic polymer is at least in part a homopolymer of dimethyldiallyl ammonium chloride.

5. A composition according to claim 4 wherein said cationic homopolymer comprises monomeric units of the formula:



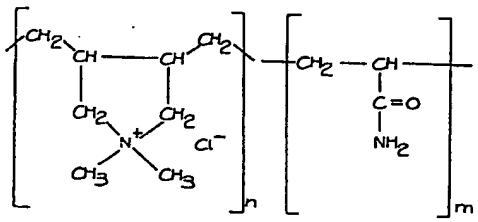


or mixtures thereof.

6. A composition according to claim 4 or 5 in which said homopolymers have a molecular weight within the range of from about 4000 to about 550,000.

7. A composition according to any of claims 1 – 3 in which said cationic polymer is a copolymer of dimethyldiallyl ammonium chloride and acrylamide.

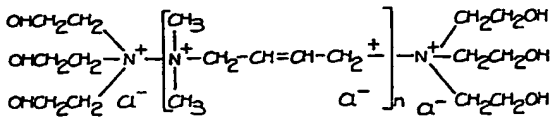
8. A composition according to claim 7 in which said cationic copolymer is made up of monomeric units of the formula:



in which n and m are molecular weight-dependent cardinal numbers and in which said copolymer has a molecular weight in the range of from about 5000 to about 550,000.

9. A composition according to any of claims 1 – 3 in which said cationic polymer is at least in part a poly(di-methylbutenyl ammonium chloride)-α,ϖ -bis(triethanol ammonium chloride).

10. A composition according to claim 9 in which said cationic polymer comprises monomeric units of the formula:



in which n is a molecular weight-dependent cardinal number and in which said cationic polymer has a molecular weight in the range of from about 800 to about 5000.

11. A composition according to any of claims 1 – 10, in which said cationic polymer is at least in part a quarternized polyvinyl pyridine.

12. The composition of claim 11, wherein said polyvinyl pyridine comprises monomeric units of the formula:

wherein R is an alkyl radical having between 1 and 20 carbon atoms, X^- is an anion and n is a molecular weight-dependant cardinal number, the polymer having a weight average molecular weight in the range of from about 5,000 to about 100,000.

13. The composition of claim 12, wherein said anion is a sulfate, halide or carboxylate.

14. A composition accordng to claim 1, whose composition is substantially as indicated in any of the foregoing Examples 1 to 5.

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